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MED in Review

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- Office of Research and Development
  - National Health and Environmental Effects Research Laboratory
    - Mid-Continent Ecology Division, Duluth, Minnesota

In this Issue:

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Research Events

MED/Grosse Ile Scientist Finalizes Role on Science Advisory Panel for NCER Grant

Russell Kreis, Chief of the MED Large Lakes & Rivers Forecasting Research Branch in Grosse Ile, MI has completed responsibilities on the Science Advisory Panel for a National Center for Environmental Research (NCER) grant, which was a collaborative venture between Western Michigan University and Altarum (Michigan Technological Institute). Russ served on the Panel for five years and also served as interim chair through the grant's final phases. Dr. Dale Manty (NCER-Washington, DC) served as project officer. The grant was entitled "Great Lakes Environmental and Molecular Sciences Center (GLEAMS)" and was a congressional earmark. The mission was to carry out novel research to better assess environmental health, and to transfer research results to the public in a manner that facilitates environmental decision-making. The Center's approach focused on state-of-the-art environmental chemistry, application of genomics-based molecular technologies, layered GIS environmental databases, and a dynamic decision support system. Beyond the final Panel review, overviews of the program and demonstration of the decision support system were provided at the State of the Upper Peninsula Meeting and State of Lake Michigan Conference, both in the State of Michigan in September and October 2007, respectively.
Contact: Russell G. Kreis Jr. (734) 692-7615

GLEAMS
Great Lakes Environmental & Molecular Sciences Center

MED Researchers Demonstrate Software Applications at SETAC Meeting, Milwaukee, Wisconsin; November 11-15

At the fall meeting of the Society of Environmental Toxicology and Chemistry, more than 100 potential users viewed and/or operated three applications developed at MED: the ECOTOX Knowledge System (www.epa.gov/ecotox), Version 1.0 of the PCB Residue database, and the beta-version of the Biota-Sediment Accumulation Factor Data set. ECOTOX is the largest collection of summarized toxic effects data for ecologically relevant species available on the Web, including more than 546,000 individual data records, and is updated on a quarterly basis. The PCB Residue database provides critical residue values for fish, mammals, and birds for PCBs and dioxin-like compounds. The application is a PC-based application that can be downloaded from the website: http://www.epa.gov/med/Prods_Pubs/pcbres.htm. The critical residue values are expressed based upon total PCBs and also expressed using the sum of the dioxin-like PCBs after adjustment using toxicity equivalence factors. The BSAF data set was assembled primarily from Superfund site investigations. It is intended as a tool for remedial project managers and risk assessors who can: 1) upload data from their own site investigations for comparison to the larger data set to determine if their results are reasonable,

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MED Researchers Demonstrate Software – *continued*

2) use the data set as a source of BSAFs when site-specific knowledge is lacking during screening assessments, and 3) understand relative bioaccumulation potentials of various chemicals. The application includes plotting templates allowing site data to be compared to query results of the PCB Residue database. The PC-based application is available for download from the website: http://www.epa.gov/med/Prods_Pubs/bsaf.htm.

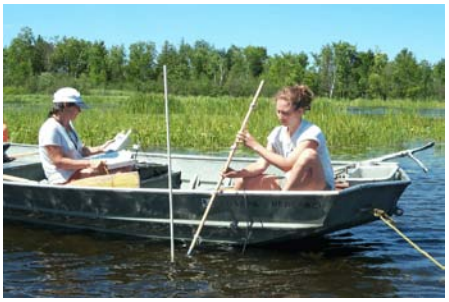
Visitors to the booth included staff from other EPA Offices and Regions; other federal agencies; state, local, and international government agencies; universities; and the private sector. Users were encouraged to bring their thumb drives for distribution of Version 1.0 of the PCB Residue database, along with quick user guides developed for each application. Users had very positive comments regarding the various applications and were appreciative that EPA was sharing these knowledge systems, databases, and tools. **Contact**: Christine Russom (218) 529-5218

Mini-symposium

On February 27th MED hosted a mini-symposium titled "Environmental Endocrine-Disrupting Chemicals and Their Effects on Fish: An Overview of Lab and Field Studies by the US Environmental Protection Agency and Environment Canada." Presentations were given by Drs. Mark McMaster, Joanne Parrott, and Mark Hewitt from Environment Canada's National Water Research Institute in Burlington, ON; and by four MED scientists, Drs. Dan Villeneuve, Gary Ankley, Dalma Martinoviæ, and Rodney Johnson. The talks by the Environment Canada scientists centered around their research on the effects of pulp mill effluents on fish reproduction. Dr. McMaster presented an overview of field based research at Areas of Concern across the Great Lakes, Dr. Parrott presented the results of laboratory studies on the effects of effluents on fish reproduction, and Dr. Hewitt's presentation covered analytical chemistry approaches to identifying the endocrine active components in pulp mill effluents. The EPA scientists presented research ranging from the cellular to the population level. Dr. Villeneuve presented a systems biology approach to understand the mechanisms by which chemicals affect fish reproduction. Dr. Ankley showed how plasma vitellogenin, a biomarker of exposure to estrogenic chemicals, along with other reproductive measures can be utilized to develop models that predict the effects of endocrine-disrupting chemicals on fish populations. Dr. Martinoviædiscussed the potential for chemicals used in concentrated animal feeding operations to have adverse effects in the aquatic environment. The morning session ended with a talk by Dr. Johnson who presented results from work with medaka showing multi-generation effects resulting from exposure to an endocrine disrupting chemical. The symposium and meetings afterward gave the EC and EPA scientists a chance to learn about the research in progress at the respective laboratories and to begin to discuss the potential for future collaborative research.

An estimated 60 people attended the morning event, with representation from local municipal offices, MN state agencies, universities, and other local organizations and individuals. The symposium was also webcast with the help of EPA Region 5 to over a dozen participants from MED-Grosse Ile, EPA Region 5, WI Department of Natural Resources, WI State Lab of Hygiene, University of Minnesota in St Paul, and Lakehead University in Thunder Bay, ON.
Contact: Michael Hornung (218) 529-5236

Sentinels of coastal change: MED helps lead effort to summarize new generation of Great Lakes indicators



Water quality sampling in a Great Lakes coastal wetland.

A special edition of the *Journal of Great Lakes Research* summarizes a new generation of indicators for coastal change in the Great Lakes. These environmental indicators are benchmarks for the current conditions of the lakes' coastal region and provide measurable endpoints to assess the success of future management, conservation, protection, and restoration of this important freshwater resource. Information on indicators is legislatively mandated by the governments of the US and Canada because of public demand to know the status of Great Lakes ecosystems. The new indicators are especially timely because of increasing recognition of human pressures in the coastal zone that affect ecosystem quality and the related services people expect from coastal ecosystems. The need to track coastal conditions recently has become a special emphasis of the International Joint Commission and is a major discussion area as revisions to the US-Canada Great Lakes Water Quality Agreement (GLWQA) are being considered.

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SENTINELS OF COASTAL CHANGE – *CONTINUED*

This coastal wetland on Lake Superior has little watershed disturbance, good water quality, and low N-15 in organism tissues.

The Division has collaborated with the STAR-funded Great Lakes Environmental Indicators Project through an EPA Cooperative Agreement with the Natural Resources Research Institute at the University of Minnesota Duluth (UMD). The JGLR special issue, guest-edited by Gerry Niemi (UMD) and Jack Kelly (Chief of MED's Ecosystem Assessment Research Branch and Adjunct Professor/UMD), contains 22 papers on the development of coastal indicators that make a link between landscape disturbance metrics and the condition of coastal receiving waters and biota. MED scientists are lead authors on papers that examine water quality in coastal wetlands through stressor-response patterns (Anett Trebitz et al., MED/ECAR) and demonstrate that 15N isotopes in aquatic biota of different coastal habitats reflect disturbance levels in the adjacent watersheds (Greg Peterson et al., MED/ECAR). Nine MED scientists are contributing co-authors to the special issue. The introductory paper provides an overview and synthesis: "Environmental Indicators for the Coastal Region of the North American Great Lakes: Introduction and Prospectus," Gerald J. Niemi, John R. Kelly, and Nicholas P. Danz (Volume 33, Special Issue 3, pp. 1-12) of the Journal of Great Lakes Research, published by the International Association for Great Lakes Research, 2007. The JGLR special issue is now available.

Kelly, Niemi, and Jan Ciborowski (University of Windsor, Canada) have been asked by Gary Gulezian, Director of the EPA Great Lakes National Program Office, to further develop the framework established by this set of papers. The effort will assist with implementation of a new generation of nearshore monitoring, establish new ground for the US-Canada SOLEC indicator and reporting process, and provide important context for the ongoing GLWQA discussions.

The National Coastal Assessment (NCA), now part of EPA Office of Water's National Surveys, will include the Great Lakes for the first time in 2010 and will be supported by NHEERL/MED/ECAR. The NCA represents an opportunity for application of the new landscape-linked indicators and for associated development of additional ecosystem service indicators. ECAR scientists will lead efforts to explore how these indicators can be implemented along US marine coasts.
Contact: Jack Kelly (218) 529-5119, kelly.johnr@epa.gov

MED SCIENTIST ON ECOSYSTEM WORK GROUP FOR IJC UPPER GREAT LAKES STUDY

The International Joint Commission has initiated the Upper Great Lakes Study to examine the outflows of the Upper Great Lakes and determine whether outflow regulation protocols should be altered in the future to benefit various interests, including recreational boating and tourism; commercial navigation; hydropower; water for municipal, industrial, and domestic uses; and ecosystems. Analyses will be conducted through two teams: the Lake Huron Outflow / St Clair River Team and the Lake Superior Regulation Team. Dr. Janet Keough of MED was invited to participate in the Ecosystem Work Group for the Lake Superior Team. This Work Group is comprised of technical experts from the US and Canada, who will oversee analyses to examine the linkage between Lake Superior outflow regulation and ecosystem functions and services in the Upper Lakes. The URL for the Upper Great Lakes Study is www.iugls.org **Contact**: Janet Keough (218) 529-5025, keough.janet@epa.gov

Featured Research

FIFRA SAP REVIEW OF ENDOCRINE DISRUPTER SCREENING PROGRAM TIER I TESTING BATTERY

Several MED scientists, along with numerous collaborators, have made major contributions to the Endocrine Disrupter Screening Program (EDSP) which is being developed and implemented by the Office of Prevention, Pesticides and Toxic Substances (OPPTS). MED's contributions to the EDSP have focused on development and validation of relatively short-term methods to screen chemicals for endocrine disrupting potential, as well as longer, more definitive methods using both fish and amphibian models. Short-term fish

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reproduction and amphibian metamorphosis assays were developed at MED as means to screen chemicals for their ability to disrupt normal function of the sex steroid pathway and the thyroid pathway. These assays were recently reviewed, as part of the EDSP Tier I screening battery, by the FIFRA Scientific Advisory Panel on March 25-27, 2008 in Arlington, VA. This review focused on the Tier 1 battery as a whole and did not address individual assays, per se. MED scientists Gary Ankley and Joe Tietge attended the review and provided technical assistance to the Office of Science Coordination and Policy, the OPPTS office responsible for the development of the EDSP.

The EDSP program resulted from the passage of the Food Quality Protection Act (FQPA) in 1996, along with amendments to the Safe Drinking Water Act and the Federal Food, Drug, and Cosmetic Act. The FQPA required EPA *"to develop a screening program, using appropriate validated test systems and other scientifically relevant information, to determine whether certain substances may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or other such endocrine effect as the Administrator may designate."*

In response to this mandate, the Agency established a multi-stakeholder federal advisory committee in 1996, the Endocrine Disrupter Screening and Testing Advisory Committee (EDSTAC), to provide advice on designing a screening and testing program for endocrine disrupting chemicals. In 1998, EDSTAC published its final report, which included three important recommendations which shaped the Agency's efforts to develop the EDSP. First, they recommended that the Agency consider additional modes of action beyond estrogenic activity by including test systems that detect effects in the androgen and thyroid pathways. Second, they expanded the taxonomic breadth of the program by recommending that tests be developed for a number of organisms, including wildlife (i.e., amphibian, fish, reptiles, birds, and invertebrates). Third, they proposed a two-tiered screening and testing approach, whereby Tier 1 screening would consist of a suite of complementary and less complex assays designed to effectively and efficiently determine if test substances perturb normal estrogen, androgen, and thyroid hormone regulation and function. If results from Tier 1 screening assays indicate that a substance does exhibit endocrine disrupting potential, then more complex and definitive dose-response testing would likely be done in a second tier of testing that would include more complex experimental designs.

EDSTAC's concept of a Tier 1 battery of tests originally included five *in vitro* test systems, primarily designed to evaluate receptor binding and transcriptional activation, and five *in vivo* test systems to evaluate whole organism responses in rats, fish, and amphibians. Although this concept was broadly supported by knowledge of the endocrinological systems of vertebrates, none of the tests was sufficiently developed to be considered "validated." In response to this, the Agency embarked on an ambitious program to develop, optimize, standardize, and validate the recommended assays, as well as other assays that emerged after the EDSTAC report. The modified Tier 1 battery proposed by the Agency now includes five *in vitro* assays which cover estrogen receptor (ER) binding, ER transcriptional activation, androgen receptor binding, steroidogenesis, and aromatase activity. The *in vivo* assays include four rat assays (uterotrophic, Hershberger, pubertal male, and pubertal female), a short-term fish reproduction assay, and an amphibian metamorphosis assay. The Agency is preparing to implement the EDSP Tier 1 battery in August 2008 and has published an initial list of 73 chemicals for Tier 1 testing.

More information on the FIFRA SAP review of the EDSP Tier I battery is available at:
www.epa.gov/scipoly/sap/meetings/2008/032508_mtg.htm
Contact: Joe Tietge (218) 529-5176.

Endocrine System Overview

The endocrine system, also referred to as the hormone system, is found in all mammals, birds, and fish. It is made up of:

- Glands located throughout the body.
- Hormones (i.e., chemical messengers) that are made by the glands and released into the bloodstream or the fluid surrounding cells.
- Receptors in various organs and tissues that recognize and respond to the hormones.

For additional endocrine system information see:
http://www.epa.gov/endo/pubs/edspoverview/primer.htm

MED PUBLICATIONS INVESTIGATE HUMAN IMPACTS ON GREAT LAKES COASTAL SYSTEMS

Investigations into the manner in which coastal ecosystems respond to anthropogenic stressors are a key element of MED's ecological research portfolio. Collaboration with the EPA Star Grant funded GLEI "Great Lakes Environmental Indicators" consortium has enabled Division researchers to quantify the links among land use practices in watersheds (as characterized from broad-scale datasets via GIS techniques)

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and the structure, function, and condition of Great Lakes coastal ecosystems. Two papers appearing in a special issue of the *Journal of Great Lakes Research* exemplify this work. (See article on pp. 2-3 in "Research Events" section of this newsletter.) The Trebitz et al. paper establishes that a broad suite of water quality parameters (e.g., nutrient concentrations, water clarity, chlorophyll, trace elements) in coastal wetlands are strongly related to the intensity of agricultural practices in the adjacent watersheds. The large range in water quality among wetlands across the Great Lakes suggests that water quality standards should probably be enacted on a sub-basin spatial scale. The Peterson et al. paper shows that aquatic organisms from various coastal systems are enriched with the N-15 isotope of nitrogen in direct proportion to the intensity of anthropogenic activities in the watershed. The N-15 to landscape linkage was strongest in coastal wetlands and embayments, but became weaker further out into the lake. Together, these papers confirm strong human influences on Great Lakes coastal ecosystems as well as influences by geographic and hydrologic gradients. The papers provide indicators for tracking anthropogenic impacts and highlight implications for establishing criteria and monitoring and assessment protocols. **Contact**: Anett Trebitz (218) 529-5209.

Peterson, G.S., M.E. Sierszen, P.M. Yurista, and J.R. Kelly. 2007. Stable nitrogen isotopes of plankton and benthos reflect a landscape-level influence on Great Lakes coastal ecosystems. *J. Great Lakes Res.* 33(SI3):27-41.

Trebitz, A.S., J.C. Brazner, A.M. Cotter, M.L. Knuth, J.A. Morrice, G.S. Peterson, M.E. Sierszen, J.A. Thompson, and J.R. Kelly. 2007. Water quality in Great Lakes coastal wetlands: Basin-wide patterns and responses to an anthropogenic disturbance gradient. *J. Great Lakes Res.* 33(SI3):67-85.

Current Events

JOINT SETAC/SOT REGIONAL CHAPTER MEETING AT MID-CONTINENT ECOLOGY DIVISION -- MARCH 31 TO APRIL 2

Midwest Chapter Society of Environmental Toxicology and Chemistry
www.midwestsetac.org

SOT Northland Chapter Society of Toxicology
http://www.toxicology.org/isot/RC/northland

A joint scientific meeting of two regional chapters was held in MED's Conference Center in Duluth, MN. Both the Midwest Chapter of the Society of Environmental Toxicology and Chemistry and the Northland Chapter of the Society of Toxicology hosted the meeting with the theme: *Action and Reaction: Challenges in Linking Exposure to Effect*. The program included oral presentations, posters, a short course, laboratory tours, and social activities. A special plenary session on *Environmental Fate and Effects of Perfluorinated Chemicals* included four invited speakers: John Butenhoff, 3M Company; Scott Mabury, University of Toronto; Chris Lau, EPA/ORD; and Geary Olsen, 3M Company. These presentations highlighted the effects, the fate and transport in the environment, mammalian models of mechanisms, and human health assessments of perfluorochemicals. MED researchers presented a short course titled *Endocrine Disrupting Chemicals (EDCs): Progress on Tier I and Tier II Testing Protocols for Small Fish and Amphibians*, that provided a background on issues related to EDCs and overviews of the various protocols developed for Tier I and Tier II testing of small fish and amphibians. The meeting had two concurrent sessions and a poster session that addressed the breadth of each society including environmental toxicology, chemistry, and risk assessment. This was a successful meeting, and impressive in terms of attendance – 170! Also, there were record-setting proceeds from the silent auction to fund student travel.
Contact: Teresa Norberg-King (218) 529-5163.

New Publications since 10/15/07

Ankley, G.T., A.L. Miracle, E.J. Perkins, and G.P. Daston (Eds.). 2007. Genomics in regulatory ecotoxicology: Applications and challenges. ***SETAC Pellston Workshop***, Pellston, MI, September 18-22, 2005, Taylor & Francis, Boca Raton, FL.

Ankley, G.T., B. Brooks, D. Huggett, and J. Sumpter. 2007. Repeating history: Pharmaceuticals in the environment. ***Environmental Science & Technology*** 41:8211-8217.

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Ankley, G.T., A.L. Miracle, and E.J. Perkins. 2007. Chapter 1. Toxicogenomics in ecological risk assessments: Regulatory context, technical background, and workshop overview. ***SETAC Pellston Workshop***, Pellston, MI, September 18-22, 2005, G.T. Ankley, A.L. Miracle, E.J. Perkins, G.P. Daston (Eds.),Taylor & Francis, Boca Raton, FL, pp. 1-12

Bennett, R.S. and M.A. Etterson. 2007. Incorporating results of avian toxicity tests into a model of annual reproductive success. ***Integrated Environmental Assessment and Management*** 3:498-507.

Bourgeau-Chavez, L., R. Lopez, A. Trebitz, T. Hollenhorst, G. Host, B. Huberty, R. Gauthier, and J. Hummer. Chapter 8. Landscape-based indicators. ***Great Lakes Coastal Wetlands Monitoring Plan***, T.M. Burton, J.C. Brazner, J.J.H. Ciborowski, G.P. Grabas, J. Hummer, J. Schneider, and D.G. Uzarski, Eds., Great Lakes Coastal Wetland Consortium Report to U.S. EPA's Great Lakes National Program Office, pp.143-171.

Brazner, J.C., N.P. Danz, A.S. Trebitz, G.J. Niemi, R.R. Regal, T. Hollenhorst, G.E. Host, E.D. Reavie, T.N. Brown, J.M. Hanowski, C.A. Johnston, L.B. Johnson, R.W. Howe, and J.J. Ciborowski. 2007. Responsiveness of Great Lakes wetland indicators to human disturbances at multiple spatial scales: A multi-assemblage assessment. ***Journal of Great Lakes Research*** 33(SI3):42-66.

Burgess, R.M., W.J. Berry, D.R. Mount, G.T. Ankley, D.S. Ireland, D.M. DiToro, D.J. Hansen, J.A. McGrath, L.D. DeRosa, H.E. Bell, F.J. Keating, M.C. Reiley, and C.S. Zarba. 2008. Procedures for the derivation of equilibrium partitioning sediment benchmarks (ESBs) for the protection of benthic organisms: Compendium of Tier 2 values for nonionic organics, ***EPA Report, EPA/600/R-02/016***.

Burkhard, L.P. and M.T. Lukasewycz. Toxicity equivalency values for polychlorinated biphenyl mixtures. ***Environmental Toxicology and Chemistry*** 27:529-534.

Daston, G.P., A.L. Miracle, E.J. Perkins, and G.T. Ankley. 2007. Chapter 7. Toxicogenomics in ecological risk assessments: A prospectus. ***SETAC Pellston Workshop***, Pellston, MI, September 18-22, 2005, G.T. Ankley, A.L. Miracle, E.J. Perkins, G.P. Daston (Eds.), Taylor & Francis, Boca Raton, FL, pp. 151-156.

Degitz, S.J., R.A. Hoke, S.P. Bradbury, R. Brennan, L. Ferguson, R. Klaper, L. Orban, D. Spurgeon, and S. Tilton. 2007. Chapter 4. Application of genomics to regulatory ecological risk assessments for pesticides. ***SETAC Pellston Workshop***, Pellston, MI, September 18-22, 2005, G.T. Ankley, A.L. Miracle, E.J. Perkins, G.P. Daston (Eds.), Taylor & Francis, Boca Raton, FL, pp. 63-85.

Ekman, D., Q. Teng, K. Jensen, D. Martinovic, D. Villeneuve, G. Ankley, and T. Collette. 2007. NMR analysis of male fathead minnow urinary metabolites: A potential approach for studying impacts of chemical exposures. ***Aquatic Toxicology*** 85:104-112.

Erickson, R.J., J.W. Nichols, P.M. Cook, and G.T. Ankley. 2008. Chapter 2. Bioavailability of chemical contaminants in aquatic systems. ***The Toxicology of Fishes***, R.T. DiGiulio and D.E. Hinton, Eds., Taylor & Francis, Boca Raton, FL, pp. 9-54.

Fort, D.J, S.D. Degitz, J.E. Tietge, and L.W. Touart. 2007. The Hypothalamic-Pituitary-Thyroid (HPT) axis in frogs and its role in frog development and reproduction. ***Critical Reviews in Toxicology*** 37:117-161.

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Hoffman, J.C., K.E. Limburg, D.A. Bronk, and J.E. Olney. 2008. Overwintering habitats of migratory juvenile American shad in Chesapeake Bay. ***Environmental Biology of Fishes*** 81:329-345.

Hoffman, J.C., D.A. Bronk, and J.E. Olney. 2007. Contribution of allochthonous carbon to American shad production in the Mattaponi River, Virginia, using stable isotopes. ***Estuaries and Coasts*** 30:1034-1048.

Hornung, M.W., P.M. Cook, P.N. Fitzsimmons, D.W. Kuehl, and J.W. Nichols. 2007. Tissue distribution and metabolism of benzo[a]pyrene in embryonic and larval medaka (*Oryzias latipes*). ***Toxicological Sciences*** 100:393-405.

Hotchkiss, A.K., J. Furr, E.A. Makynen, G.T. Ankley, and L.E. Gray, Jr. 2007. In utero exposure to the environmental androgen trenbolone masculinizes female Sprague-Dawley rats. ***Toxicology Letters*** 174:31-41.

Kavlock, R.J., G.T. Ankley, J. Blancato, M.S. Breen, R.B. Conolly, D. Dix, K. Houck, E. Hubal, R. Judson, J. Rabinowitz, A.M. Richard, R.W. Setzer, I. Shah, D.L. Villeneuve, and E. Weber. 2008. Computational toxicology -- A state of the science mini review. ***Toxicological Sciences*** 103:14-27.

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Kleinow, K.M., J.W. Nichols, W. L. Hayton, J.M. McKim, and M.G. Barron. 2008. Chapter 3, Toxicokinetics in fishes. In: ***The Toxicology of Fishes***, R.T. DiGiulio and D.E. Hinton (Eds.), Taylor & Francis, Boca Raton, FL, pp. 55-152.

Martinovic, D., L.S. Blake, E.J. Durhan, K.J. Greene, M.D. Kahl, K.M. Jensen, E.A. Makynen, D.L. Villeneuve, and G.T. Ankley. 2008. Reproductive toxicity of vinclozolin in the fathead minnow: Confirming an anti-androgenic mode of action. ***Environmental Toxicology and Chemistry*** 27:478-488.

Martinovic, D., J.S. Denny, P.K. Schmieder, G.T. Ankley , and P.W. Sorensen. 2008. Temporal variation in the estrogenicity of a sewage treatment plant effluent and its biological significance. ***Environmental Science & Technology*** 42:3421-3427.

Mattson, V.R., J.R. Hockett, T.L. Highland, G.T. Ankley, and D.R. Mount. 2008. Effects of low dissolved oxygen on organisms used in freshwater sediment toxicity tests. ***Chemosphere*** 70:1840-1844.

Morrice, J.A., N. Danz, R.R. Regal, J.R. Kelly, E.D. Reavie, T. Hollenhorst, R.P. Axler, A.S. Trebitz, A.M. Cotter, and G.S. Peterson. 2008. Human influences on water quality in Great Lakes coastal wetlands. ***Environmental Management*** 41:347-357.

Mount, D.R. and T.R. Henry. 2008. Chapter 18. Ecological Risk Assessment. In: ***The Toxicology of Fishes***, R.T. DiGiulio and D.E. Hinton (Eds.), Taylor & Francis, Boca Raton, FL, pp. 757-775.

Nichols, J.W., S. Erhardt, S.D. Dyer, M.O. James, M.M. Moore, K.P. Plotzke, H. Segner, I.R. Schultz, L. Vasiluk, and A. Weisbrod. 2007. Workshop Report: Use of *in vitro* absorption, distribution, metabolism and excretion (ADME) data in bioaccumulation assessments for fish. ***Human and Ecological Risk Assessment*** 13:1164-1191

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Parkerton, T., J. Arnot, A. Weisbrod, C. Russom, R. Hoke, K. Woodburn, T. Traas, M. Bonnell, L. Burkhard, and M. Lampi. 2008. Guidance for evaluating in-vivo fish bioaccumulation data. ***Integrated Environmental Assessment and Management*** 4:139-155.

Pauer, J.J., K. Taunt, W. Melendez, R.G. Kreis, and A. Anstead. 2007. Resurrection of the Lake Michigan eutrophication model, MICH1. ***Journal of Great Lakes Research*** 33:554-565.

Peterson, G.S., M.E. Sierszen, P.M. Yurista, and J.R. Kelly. 2007. Stable nitrogen isotopes of plankton and benthos reflect a landscape-level influence on Great Lakes coastal ecosystems. ***Journal of Great Lakes Research*** 33(SI3):27-41.

Spehar, R.S., S.M. Cormier, and D.L. Taylor. 2007. Candidate Causes: Sediments. *In:* Causal Analysis, Diagnosis Decision Information System; USEPA Website. Guidance document /CADDIS module. ***http://cfpub.epa.gov/caddis/candidate.cfm***. 4938

Tillitt, D.E., P.M. Cook, J.P. Giesy, W. Heideman, and R.E. Peterson. 2008. Reproductive impairment of Great Lakes lake trout by dioxin-like chemicals. In: ***The Toxicology of Fishes***, R.T. DiGiulio and D.E. Hinton (Eds.), Taylor & Francis, Boca Raton, FL, pp. 819-875.

Trebitz, A.S., J.C. Brazner, A.M. Cotter, M.L. Knuth, J.A. Morrice, G.S. Peterson, M.E. Sierszen, J.A. Thompson, and J.R. Kelly. 2007. Water quality in Great Lakes coastal wetlands: Basin-wide patterns and responses to an anthropogenic disturbance gradient. ***Journal of Great Lakes Research*** 33(SI3):67-85.

Trebitz, A.S. and D.L. Taylor. 2007. Exotic and invasive aquatic plants in Great Lakes coastal wetlands: Distribution and relation to watershed land use and plant richness and cover. ***Journal of Great Lakes Research*** 33:705-721.

Wang, R.-L., A.D. Biales, D.C. Bencic, D.L. Lattier, M. Kostich, D.L. Villeneuve, G.T. Ankley, J.M. Lazorchak, and G.P. Toth. 2008. DNA microarray application in ecotoxicology: Experimental design, microarray scanning, and factors impacting transcriptional profiles in a small fish species. ***Environmental Toxicology and Chemistry*** 27:652-663.

Wang, R.-L., A.D. Biales, D.C. Bencic, D.L. Lattier, M. Kostich, D.L. Villeneuve, G.T. Ankley, J.M. Lazorchak, and G.P. Toth. 2008. DNA microarray-based ecotoxicological biomarker discovery in a small fish model species. ***Environmental Toxicology and Chemistry*** 27:664-675.

Watkins, J.M., R. Dermott, S.J. Lozano, E.L. Mills, L.G. Rudstam, and J.V. Scharold. 2007. Evidence for remote effects of dreissenid mussels on the amphipod *Diporeia*: Analysis of Lake Ontario benthic surveys, 1972-2003. ***Journal of Great Lakes Research*** 33:642-657.

MED Seminars

Poster Session

The MED Seminar Committee typically organizes and advertises our weekly technical seminars by internal and external experts. The Committee held its second annual Poster Session on December 12, 2007. Twenty-three posters displaying research conducted by MED scientists were presented in our Gitchee Gumee Conference Center. These posters had been presented previously at professional meetings during the 2007 calendar year. The session provided a great opportunity for the MED staff and outside attendees to get a glimpse of the breadth of research at MED. The 3rd Annual MED Poster Session is tentatively scheduled for December 3, 2008.

Recent Seminars

Jan.16
Murray Lantner, EPA Region 2,
Water Compliance Branch
• Clean Water Act NPDES enforcement overview: Authorities, current priorities, and some personal case studies

Jan. 23
Jamie Juenemann, Associate Director, Silver Creek Institute, Two Harbors, MN
• Energy from sustainable sources

Jan. 30
Dr. Robin Sternberg, EPA/MED, NRC Associate
• The roles of androgen, estrogen, and retinoid signaling in reproductive recrudescence of the eastern mud snail (*Ilyanassa obsoleta)*: Implications for the mechanism of tributyltin-induced imposex

Feb. 6
Dr. David Miller, EPA/MED
• Quantitative evaluation of a multi-trophic level ecosystem model for population dynamics of the invasive species *Bythotrephes longimanus* in Lake Michigan

Feb. *27*
*Mini-symposium****: Environmental endocrine disrupting chemicals in fish: Identifying sources, toxic modes of action, and adverse effects***

March 5
Jesse Schomberg, MN Sea Grant, Duluth
• Smart growth and low-impact development related to water quality and climate change

March 12
Jane Mosel and **Mike Bares,** MPCA, Duluth
• St. Louis River/Interlake/Duluth Tar (SLRIDT) Superfund Site: Site, remedy, and status overview

March 19
Cree Bradley, Silver Creek Institute
• Sustainable agriculture in the Lake Superior region

March 26
Dr. Stephanie Guildford, University of Minnesota Duluth, Biology/Large Lakes Observatory
• Nuisance and harmful algal blooms in the Lower Great Lakes

April 9
Michael Fulton, NOAA Hollings Marine Laboratory, Charleston, SC
• The use of Grass Shrimp (*Palaemonetes sp.*) in ecotoxicology research

April 21
Dr. Amy Ando, University of Illinois, Urbana-Champaign
• Freshwater ecosystem services: Humans as agents of change and receivers of benefits

April 24
Dr. Dan Campbell, EPA, National Health and Environmental Effects Research Lab, Atlantic Ecology Division
• Evaluating the contributions of the environment to society

April 30
Susan Darley-Hill and **A.J. Matthews**, Western Lake Superior Sanitary District, Duluth
• Recycling food waste and household hazardous waste

Awards

MED 2007 STAA

Scientific and Technological Achievement Awards are sponsored by EPA's Office of Research and Development to recognize publications demonstrating scientific excellence in support of the Agency's mission. Publications are reviewed and selected annually by EPA's Science Advisory Board, a panel of experts from outside the Agency. The following sets of papers won awards for 2007.

LEVEL II

Burkhard, L.P., P.M. Cook, and M.T. Lukasewycz. 2004. Biota-sediment accumulation factors for polychlorinated biphenyls, dibenzo-p-dioxins, and dibenzofurans in southern Lake Michigan lake trout *(Salvelinus namaycush)*. ***Environmental Science & Technology*** 38:5297-5305.

Burkhard, L.P., P.M. Cook, and M.T. Lukasewycz. 2005. Comparison of biota-sediment accumulation factors across ecosystems. ***Environmental Science & Technology*** 39:5716-5721.

Burkhard, L.P., P.M. Cook, and M.T. Lukasewycz. 2006. A hybrid empirical-mechanistic modeling approach for extrapolating BSAFs and BAFs across species, time, and/or ecosystems. ***Environmental Toxicology and Chemistry*** 25:1946-1952.

Erickson, R.J., J.M. McKim, G.J. Lien, A.D. Hoffman, and S.L. Batterman. 2006. Uptake and elimination of ionizable organic chemicals at fish gills: I. Model formulation, parameterization, and behavior. ***Environmental Toxicology and Chemistry*** 25:1512-1521.

Erickson, R.J., J. McKim, G.J. Lien, A.D. Hoffman, and S.L. Batterman. 2006. Uptake and elimination of ionizable organic chemicals at fish gills: II. Observed and predicted effects of pH, alkalinity, and chemical properties. ***Environmental Toxicology and Chemistry*** 25:1522-1532.

LEVEL III

Ankley, G.T., K.M. Jensen, E.J. Durhan, E.A. Makynen, B.C. Butterworth, M.D. Kahl, D.L. Villeneuve, A. Linnum, L.E. Gray, M. Cardon, and V.S. Wilson. 2005. Effects of two fungicides with multiple modes of action on reproductive endocrine function in the fathead minnow *(Pimephales promelas)*. ***Toxicological Sciences*** 86:300-308.

Hornung, M.W., K.M. Jensen, J.J. Korte, M.D. Kahl, E.J. Durhan, J.S. Denny, T.R. Henry, and G.T. Ankley. 2004. Mechanistic basis for estrogenic effects in fathead minnow *(Pimephales promelas)* following exposure to the androgen 17á-methyltestosterone: Conversion of 17á-methyltestosterone to 17á-methylestradiol. ***Aquatic Toxicology*** 66:15-23.

Ankley, G.T. and D.L. Villeneuve. 2006. The fathead minnow in aquatic toxicology: Past, present, and future. ***Aquatic Toxicology*** 78:91-102

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HONORABLE MENTION

Hill, B.H., C.M. Elonen, T.M. Jicha, A.M. Cotter, A.S. Trebitz, and N. Danz. 2006. Sediment microbial enzyme activity as an indicator of nutrient limitation in Great Lakes coastal wetlands. ***Freshwater Biology*** 51:1670-1683.

Durhan, E.J., C.S. Lambright, E.A. Makynen, J. Lazorchak, P. Hartig, V. Wilson, L. Gray, and G.T. Ankley. 2006. Identification of metabolites of trenbolone acetate in androgenic runoff from a beef feedlot. ***Environmental Health Perspectives*** 114:65-68.

Jensen, K.M., E.A. Makynen, M.D. Kahl, and G.T. Ankley. 2006. Effects of the feedlot contaminant 17á-trenbolone on reproductive endocrinology of the fathead minnow. ***Environmental Science & Technology*** 40:3112-3117.

Scharold, J.V., S.J. Lozano, and T.D. Corry. 2004. Status of the amphipod *Diporeia* spp. in Lake Superior, 1994-2000. ***Journal of Great Lakes Research*** 30 (Suppl.1):360-368.

Heinis, L.J., T.L. Highland, and D.R. Mount. 2004. Method for testing the aquatic toxicity of sediment extracts for use in identifying organic toxicants in sediments. ***Environmental Science & Technology*** 38:6256-6262.

Sierszen, M.E., J. Morrice, M. Moffett, and C. West. 2004. Benthic versus planktonic foundations of three Great Lakes coastal wetland food webs. ***Journal of Great Lakes Research*** 30:31-43.

Sierszen, M.E., G.S. Peterson, A.S. Trebitz, J.C. Brazner, and C.W. West. 2006. Hydrology and nutrient effects on food web structure in ten Lake Superior coastal wetlands. ***Wetlands*** 26:951-964.

Etterson, M.A. and R.S. Bennett. 2005. Including transition probabilities in nest-survival estimation: a Mayfield Markov Chain. ***Ecology*** 86:1414-1421.

Etterson, M.A. and R.S. Bennett. 2006. The effects of uncertainty about age at transition on bias in the Mayfield family of estimators. ***Ecological Modelling*** 199:253-260.

Yurista, P.M., J.R. Kelly, and S.E. Miller. 2005. Evaluation of optically acquired zooplankton size-spectrum data as a potential tool for assessment of condition in the Great Lakes. ***Environmental Management*** 35:34-44.

Yurista, P.M., J.R. Kelly, and S.E. Miller. 2006. Comparisons of zooplankton community size structure in the ***Great Lakes. Journal of Geophysical Research, Oceans Special Issue*** 111:1-12.

2007 EPA NATIONAL HONOR AWARD

Paul G. Keough Award for Administrative Excellence: Rodney H. Booth, MED Facilities Manager
– for excellence in facilities management

People

Jason Fierst Moves On

Jason Fierst, General Supply Specialist, left MED in December for a new life at Camphill Village, a planned community on a 470-acre biodynamic farm near Sauk Centre, MN. The Village is part of the international Camphill movement for social renewal through community living. In its 100 centers, people share life and work with children and adults with disabilities. Jason and his family are houseparents to special-needs residents, and participate in and support such activities as farming, weaving, baking, printmaking, woodworking, and pottery-making. For more information on Camphill please visit: http://www.camphillvillage-minnesota.org/index.html.

Jason Fierst

Pat Smith Retires

Pat Smith, Senior Environmental Employee, who worked in Program Operations/Technical Information for 10 years, retired in January. We miss her strong work ethic, attention to detail, awesome recipes (like Italian Olive Salad), wonderful candy jar, and the daily newspaper she supplied for the lunchroom.

Pat Smith

Region 2 Scientist Visits MED

Murray Lantner

Region 2 scientist, Murray Lantner, P.E., spent two weeks at MED in January 2008 as part of the Regional Research Partnership (RRP) Program. RRP is designed to provide short-term training opportunities for regional technical staff to work directly with scientists in the ORD laboratories and centers.

This RRP exchange focused on technology transfer to Region 2 of information pertaining to aquatic toxicology, endocrine disrupting compounds (EDCs), and whole effluent toxicity, as well as an array of information pertaining to current research topics, laboratory methods, sample analysis and equipment, and ecological assessment. To achieve these objectives, we set up an intensive schedule of hands-on laboratory work and one-on-one visits with both technical and senior staff. Mr. Lantner worked in or toured laboratories and spoke with scientists who conduct research on endocrine disruptors, such as perchlorate, ethinylestradiol (EE2), and trenbolone; and toxins, such as arsenic. He contributed to various studies by providing competent hands-on help in the lab. Mr. Lantner was able to run a whole effluent toxicity chronic test using the invertebrate, *Ceriodaphnia dubia*. (This test is a permit requirement in many NPDES Permits that he enforces.) Besides learning about the test methodology, he gained understanding of how the test results are obtained and how they relate to regulatory goals of the region. In addition, this visit expanded Mr. Lantner's knowledge of several different MED science activities, including: the status of the amphibian thyroid assay; how standards for water quality criteria are established; the conduct of multigenerational tests for EDCs using amphibians and fish; the methods used for sediment toxicity testing; the analytical methods used for metals, organics, steroid hormones, and gonadal histology of fish and amphibians; and the status of EPA's Ecological Monitoring and Assessment Program (EMAP).

Region 2's Regional Science Needs Survey places a priority on information related to emerging chemicals, including regulations, monitoring strategies, methods for analysis, human health, and environmental effects. This RRP focused on these regional needs by transferring the current research information on EDCs and impacts of emerging chemicals on aquatic fauna. In addition, increased knowledge of aquatic toxicity will lead to better environmental protection through more comprehensive permits and enforcement actions, which require additional monitoring and permit requirements related to emerging chemicals. Building such knowledge at the regional level in the enforcement branch will help staff to identify threats, understand new permit requirements, and find solutions to problems associated with emerging chemicals.

There were several highlights of this exchange, including these excerpts from Mr. Lantner's RRP report.

"First it (the RRP) allowed me to see a side of the EPA that is planning and conducting advanced research with global partners. The quality and caliber of the people that I met at MED were outstanding.

The best parts were being able to set up and run a toxicity test on C. dubia which involved feeding, counting, and evaluating the organisms. This toxicity test is widely used in the NPDES program and an important tool for screening toxic effluent and the synergistic effects of mixtures containing several different pollutants.

Another highlight was giving a 45 minute seminar that was attended by approximately 40 MED personnel. The seminar topic was Clean Water Act history and some personal enforcement action case studies over my 15 years at EPA. It was exciting to share some real world examples of enforcement actions with them, especially because the permit limits that we are enforcing are based upon toxicology research which took place years ago at MED. It also allowed me to show a side of EPA that they don't normally encounter and a good opportunity to interact with MED staff.

The RRP is truly a beneficial program for all involved, because it brings so much knowledge back from the EPA labs to the regions and fosters partnerships and collaboration in the future."

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